ANNUAL REPORT

April 1, 1995 - March 30, 1996

NECHAKO FISHERIES CONSERVATION PROGRAM

(A joint Program of the Government of Canada,
Alcan, and the Province of British Columbia)

P.O. Box 2551, Vanderhoof, B.C. V0J 3A0

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*Appendices D and E are currently unavailable in the digital format of this document. Please contact Triton for the full version of this document.

Under the terms of the 1987 Settlement Agreement between Alcan Aluminium Limited, the Government of Canada and the Province of British Columbia, the Nechako Fisheries Conservation Program (NFCP) is in the 8th year of implementation of a program of studies related to the conservation of chinook and sockeye salmon in the upper Nechako River. These studies have included pilot tests of remedial measures, monitoring of adult and juvenile abundance and condition, and flow control measures. This work continued into the 1995/96 program year.

In 1995/96, the NFCP directed the Allocation of Flows project to achieve the most advantageous flows for chinook and sockeye salmon. In addition, the Summer Water Temperature Management Program was successful in maintaining the majority of mean daily water temperatures at or below 20.0ºC, for the benefit of sockeye salmon migrating through the Nechako River. As well, research into measurement of the inflows from the Cheslatta-Murray system was completed.

Also in 1995/96, the pilot testing of remedial measures (habitat complexes) installed in the upper river to enhance cover opportunities for chinook continued, with similar results as previous years. Chinook fry utilized the complexes extensively throughout the study period.

Adult monitoring projects also continued in 1995/96, and 1,689 chinook spawners were estimated in the Nechako River. As in previous years, the dominant age class was 5 year old chinook. Monitoring of gravel quality and dissolved oxygen, temperature and physical data, fry emergence, juvenile outmigration and winter physical conditions in 1995/96 all resulted in further baseline data. The correlation between the number of spawners during the previous fall and the index of emergent fry remains very strong, indicating consistent conditions in the incubation environment. The 1995/96 index of juvenile outmigrants also showed a positive linear relationship to the number of spawners, supporting evidence that conditions in the river were similar to that of previous years.

Applied research on the issues of predation and competition in the Nechako River and on temperature effects on invertebrates was expected to occur in 1995/96, but no work was completed. These projects have been discontinued. However, work on developing a chinook life history model, and a study of the ecology of juvenile chinook salmon in the Nechako River were approved projects for next year.

With the cancellation of Kemano Completion Project (KCP) in 1995, the flow regime is no longer expected to change, and the evaluation framework, the framework integrating these projects, will be reconsidered in the future. However, there remains a need to evaluate the information as it is collected. Work on refining the decision pathways and criteria, and documentation of work completed to date was conducted in 1995/96.

In 1980, Alcan Aluminium Limited proposed to use the remaining portion of its water rights granted by the Provincial Crown in 1950. Alcan planned to divert water from the Nechako River to expand its hydroelectric facilities to produce power for additional aluminum smelting facilities in northwestern British Columbia. To establish appropriate fisheries conservation measures and stock monitoring projects, several years of scientific and engineering studies were undertaken by the federal government and Alcan.

In September 1987, Alcan, the Government of Canada and the Province of British Columbia signed an agreement for the conservation of Nechako River chinook salmon and the protection of migrating sockeye salmon populations in the Nechako River. Known as the 1987 Settlement Agreement, this agreement led to the establishment of the Nechako Fisheries Conservation Program (NFCP). The NFCP identified an annual allocation of water for fish, including releases to reduce water temperatures for the benefit of sockeye during July and August; a Conservation Goal for chinook (including harvest plus escapement of 1,700 to 4,000 spawners); and a program of monitoring, pilot testing of remedial measures and applied research to assure that the Conservation Goal is achieved.

The 1987 Agreement included the requirement that Alcan develop a water release facility at Kenney Dam to provide control of flow and temperature to protect salmon. It also described the flows required before (short term annual water allocation) and after (long term annual water allocation) completion of the facility. NFCP monitoring projects were designed to collect baseline data during the short term flows as a basis for comparison to conditions after the completion of the release facility and the shift to the lower long term flow. Further discussion regarding the terms of the agreement may be found in the 1988/89 NFCP Annual Report.

The NFCP is comprised of a Technical Committee and a Steering Committee. The Technical Committee is responsible for the implementation and ongoing administration of the program of remedial measures, monitoring and applied research to achieve the conservation goal. The Steering Committee is responsible for overseeing the implementation of the Settlement Agreement, and approving the annual program of activities relating to the achievement of the Conservation Goal as submitted by the Technical Committee.

During 1987-1988, the first year of the NFCP, operating procedures and a five year program framework of activities were developed in anticipation of a reduction in Nechako River flows. In addition, a strategic framework was developed by the Technical Committee to direct the overall plan (see previous annual reports). It focused on specific and measurable elements of habitat and chinook ecology. The framework provides guidelines for testing and executing remedial measures, as well as the monitoring of stock and habitat performance and research into the ecology of Nechako River chinook. Under the strategic framework, the Technical Committee designed three flow charts to assist in the understanding of how committee activities are directed. These included:

1) **The Decision Chart** used in the evaluation of selection, implementation and success of Remedial Measures (Appendix A.1).
2) **The NFCP Early Warning Monitoring Program** used to assess trends reflected by monitoring programs targeted at juvenile chinook life histories and to suggest actions to be taken in response to these trends (Appendix A.2).
3) **Assessment of the Conservation Goal** which presents an assessment of achievements and shows the extrinsic and intrinsic factors that may affect Nechako River chinook production (Appendix A.3).

Remedial Measures

Projects to test and evaluate appropriate remedial measures, which were intended to protect against any change in the chinook salmon habitat following implementation of the long-term flow regime under KCP, have been a focus of the first seven years of the NFCP work. Three stages of remedial measures (Levels A, B, and C) identified in the Settlement Agreement were developed in accordance with the Department of Fisheries and Oceans Policy for the Management of Fish Habitat.

To date only Level A measures have been tested. Several types of habitat complexes have been tested, assessed, modified and reassessed for structural integrity and juvenile chinook utilization. Characteristics of natural cover already existing in the river were incorporated into habitat complexes constructed and maintained over the past 8 years. Ongoing assessments continue to help define the characteristics of the complexes best suited to meet the needs of Nechako River chinook. Rail debris catchers are proving the most durable of the in-stream habitat complex types. Results from biological sampling indicate that the habitat complexes are well used by chinook fry. There is also continued evidence that the complexes are used as overwintering habitat by chinook.

Monitoring

The second component of the NFCP involved developing and implementing monitoring projects on stock and habitat performance. The projects have been designed to detect changes in physical and bio-

logical parameters, by collecting baseline data on stock strength. To date, efforts have been directed at establishing monitoring projects which would expand the existing database. Monitoring studies were targeted at three life history phases of Nechako River chinook salmon.

The primary monitoring measure for chinook salmon is the number of adult chinook returning to the Nechako River to spawn. To help assess whether the Conservation Goal is being achieved, adult spawning enumeration is undertaken annually. Enumeration and carcass recovery are also conducted in the Stuart River as control in a river with fish stocks of similar life history patterns. This provides an opportunity to compare relative numbers of returning adult chinook salmon. Various population characteristics such as age structure, sex ratio, length and egg retention in females are also measured.

Secondary monitoring measures include juvenile outmigration monitoring and monitoring of fry emergence to develop an egg/alevin survival index. These measures can provide an early indication of life cycle stresses or productivity changes in the system four or five years before the effects may be observed in returning adult spawners.

Tertiary measures include the monitoring of habitat quality parameters such as gravel quality, ice conditions and temperature.

The primary monitoring measure for sockeye salmon is the summer water temperature at Finmoore, just upstream of the confluence of the Nechako and Stuart rivers.

Applied Research

A third component of the Program involved identifying and implementing applied research programs which will aid in the overall understanding of Nechako River chinook life history and ecology. Research on overwintering juvenile chinook populations has examined winter abundance and distribution within the Nechako River. Knowledge of the relative contribution of the overwintering chinook to the total recruitment is necessary in order to better understand the life history of the Nechako River stock. In addition, research into predator/prey relationships has been conducted to identify predators, define the potential risks posed to chinook populations, and determine what, if any, action may be required. The resulting reports on fish and bird predation and chinook availability have been published (Brown 1995[1]; Brown et al. 1994[2]). Research to gain an understanding of the effects of temperature (cooler water released from the Kenney Dam Release Facility) on invertebrate production and fish growth was initiated in 1993/94.

Chronology of Significant Events

Field projects for the first year of an initial five-year plan began in 1988. Construction of the Kemano Completion Project (KCP), initiated in 1988, was halted by Alcan in 1991 as a result of the uncertainty created by a federal court decision which set aside the 1987 Settlement Agreement. That decision was overturned by the Federal Court of Appeal in 1992 and leave to appeal that decision was dismissed by the Supreme Court of Canada in February 1993, confirming the legal validity of the 1987 Settlement Agreement.

In January 1993, the Province of British Columbia directed the British Columbia Utilities Commission (BCUC) to conduct a public review of the Kemano Completion Project. From April 1, 1994 until June 1994 the Nechako Fisheries Conservation Program Technical Committee was involved in preparing and presenting evidence to the BCUC outlining the mandate of the NFCP and the progress of the program to date.

On January 23, 1995, the Province announced that it would not allow the Kemano Completion Project to proceed. However, the NFCP continues to have ongoing responsibility for managing the annual water allocation and the summer water temperature program, and undertaking projects that enable the Technical Committee to assess and/or respond to achievement of the Conservation Goal. It was decided to carry on with the collection of data to maintain a database to complete at least 10 years (two life cycles of chinook) of data while the program for subsequent years is being evaluated. Remedial measures projects such as the Cheslatta-Murray inflow management project will be scaled back or discontinued in the future. Monitoring projects will continue. However, given that the focus of the strategic framework is on the detection of the effects of changes in flow on the aquatic environment, and that flow changes will not occur due to the cancellation of KCP, the Technical Committee will be re-evaluating this framework, as deemed appropriate, in the future.

[1]Brown, T.G. 1995. Stomach contents, distribution, and potential of fish predators to consume juvenile chinook salmon (*Oncorhynchus tshawytscha*) in the Nechako and Stuart River, B.C. Can. Tech. rep. Fish. Aquat. Sci. 2077: 39p.

[2]Brown, T.G., E. White, D. Kelly, I. Rzen, and J. Rutten. 1994. Availability of juvenile chinook salmon to predators along the margins of the Nechako and Stuart Rivers, B.C. Can. MS. Rep. Fish Aquat. Sci. 2245: 34p.

Year 8 - Project Summary
Year 9 - Approved Projects

This Annual Report for 1995/96 covers Year 8 of the Nechako Fisheries Conservation Program. It describes the operations of the NFCP, the development of the program and its various components. In light of the rejection of KCP, the focus of the NFCP has shifted to the monitoring component of the program to provide continuity of the database, and to finalizing some of the remedial measures projects. This report provides the rationale and review of the remedial measures, monitoring of stock and habitat performance, and applied research projects undertaken in 1995/96 (Year 8). It also includes a brief description of approved projects for Year 9 (1996/97) of the NFCP. A summary chart presents a review of all projects carried out since 1987 (Chart 1).

In Year 8 of the NFCP (April 1, 1995 to March 31, 1996) the Technical Committee convened 16 meetings. Annual reports from 1988/89 to 1994/95 are available and provide information on specific projects and test results of remedial measures, habitat and stock monitoring and applied research. A summary report on 1991/92 projects is also available.

YEAR 8: PROJECT SUMMARY (1995/96)

REMEDIAL MEASURES

FLOW MANAGEMENT
- Cheslatta/Murray Lakes Inflow Forecast Procedure
- Allocation of Flows
- Summer Water Temperature and Flow Management Projects

IN-STREAM HABITAT COMPLEXES
- Physical Assessment of In-Stream Habitat Complexes
- Biological Assessment of Habitat Complexes

HABITAT AND STOCK MONITORING

ADULT PROGRAMS
- Adult Spawner Enumeration
- Adult Carcass Recovery

INCUBATION ENVIRONMENT
- Gravel Quality and Dissolved Oxygen Monitoring
- Fry Emergence
- Winter Physical Conditions

JUVENILE OUTMIGRATION

TEMPERATURE MONITORING/PHYSICAL DATA COLLECTION

EVALUATION FRAMEWORK/TREND ANALYSIS

APPLIED RESEARCH

PREDATION AND COMPETITION

TEMPERATURE EFFECTS

YEAR 9: APPROVED PROJECTS (1996/97)

REMEDIAL MEASURES

FLOW MANAGEMENT
- Allocation of Flows
- Summer Water Temperature and Flow Management Projects

IN-STREAM HABITAT COMPLEXES
- Physical Assessment of In-Stream Habitat Complexes
- Biological Assessment of Habitat Complexes

HABITAT AND STOCK MONITORING

ADULT PROGRAMS
- Adult Spawner Enumeration
- Adult Carcass Recovery

INCUBATION ENVIRONMENT
- Gravel Quality and Dissolved Oxygen Monitoring
- Fry Emergence
- Winter Physical Conditions

JUVENILE OUTMIGRATION

TEMPERATURE MONITORING/PHYSICAL DATA COLLECTION

EVALUATION FRAMEWORK/TREND ANALYSIS

APPLIED RESEARCH

CHINOOK LIFE HISTORY MODEL

ECOLOGY OF JUVENILE CHINOOK SALMON

Chart 1: Summary of NFCP Projects by Year

Program		Years Collected							
	#	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96
REMEDIAL MEASURES									
Cheslatta Murray Data Collection	6		x	x	x	x	x		x
Summer Temperature Management	8	x	x	x	x	x	x	x	x
Instream Habitat Modification	8	x	x	x	x	x	x	x	x
Fertilization	5	x	x	x	x	x			
Biological Assessment of Habitat Complexing	7		x	x	x	x	x	x	x
Inventory of Habitat	2		x	x					
Inventory of Sediment	1		x						
Flow Control	7		x	x	x	x	x	x	x
Winter Remedial Measures	1			x					
River Bed Survey HEC-2 Model	1			x					
Riparian Bank Stabilization	3				x	x	x		
MONITORING									
Adult Chinook Spawner Enumeration	8	x	x	x	x	x	x	x	x
Chinook Carcass Recovery	8	x	x	x	x	x	x	x	x
Juvenile Outmigration Monitoring	8	x	x	x	x	x	x	x	x
Winter Physical Conditions	8	x	x	x	x	x	x	x	x
Physical Data Collection	8	x	x	x	x	x	x	x	x
Fry Emergence	7		x	x	x	x	x	x	x
Gravel Quality	5	x	x	x	x	x			
Dissolved Oxygen Monitoring	5				x	x	x	x	x
Evaluation Framework and Trend Analysis	5				x	x	x	x	x
APPLIED RESEARCH									
Ecology of Juvenile Chinook Salmon	0								
Chinook Life History Model	1		x						
Predator Prey Studies	6			x	x	x	x	x	x
Temperature Effects	4					x	x	x	x
Chinook Overwintering	5	x	x	x		x	x		

FLOW MANAGEMENT

Cheslatta-Murray Inflow Measurement

RATIONALE

To make the best use of the annual water allocation from the Nechako Reservoir, it is necessary for the NFCP to know the magnitude and timing of inflows from the Cheslatta-Murray Lakes watershed.

PROJECT SUMMARY 1995/96

In 1995/1996, hydrological data including stream flow, meteorological and snow course information collected in the Bird Creek sub-basin from 1989 to 1993 was summarized and compared to data from regional stations. The information was documented in a summary report.

A forecast procedure is being finalized for use in estimating Cheslatta-Murray Lakes watershed inflows to the Nechako River. The data collected from 1989 to 1993 is being used to develop a relationship between the Bird Creek watershed hydrological characteristics and the volume and timing of its runoff. The resulting predicted Bird Creek sub-basin inflow volume will then be extrapolated to the entire Cheslatta-Murray basin.

APPROVED PROJECT 1996/97

No project work is planned in 1996/97.

Allocation of Flows

RATIONALE

The management of the annual water allocation to the Nechako River is designed to benefit fish in the river and achieve the Conservation Goal of the Settlement Agreement. To meet the objectives for flow control in the Nechako River, necessary adjustments must be made regarding Skins Lake Spillway releases.

PROJECT SUMMARY 1995/96

The annual water allocation was again managed by the NFCP Technical Committee to achieve the most advantageous flows for chinook and sockeye.

Skins Lake Spillway releases were scheduled and the spring and summer mean monthly flows were monitored by recording mean daily releases from Skins Lake Spillway and mean daily flows at the gauging station on the Nechako River below Cheslatta Falls. Reservoir releases from Skins Lake Spillway and flow in the Nechako River are shown in Figures 1 and 2.

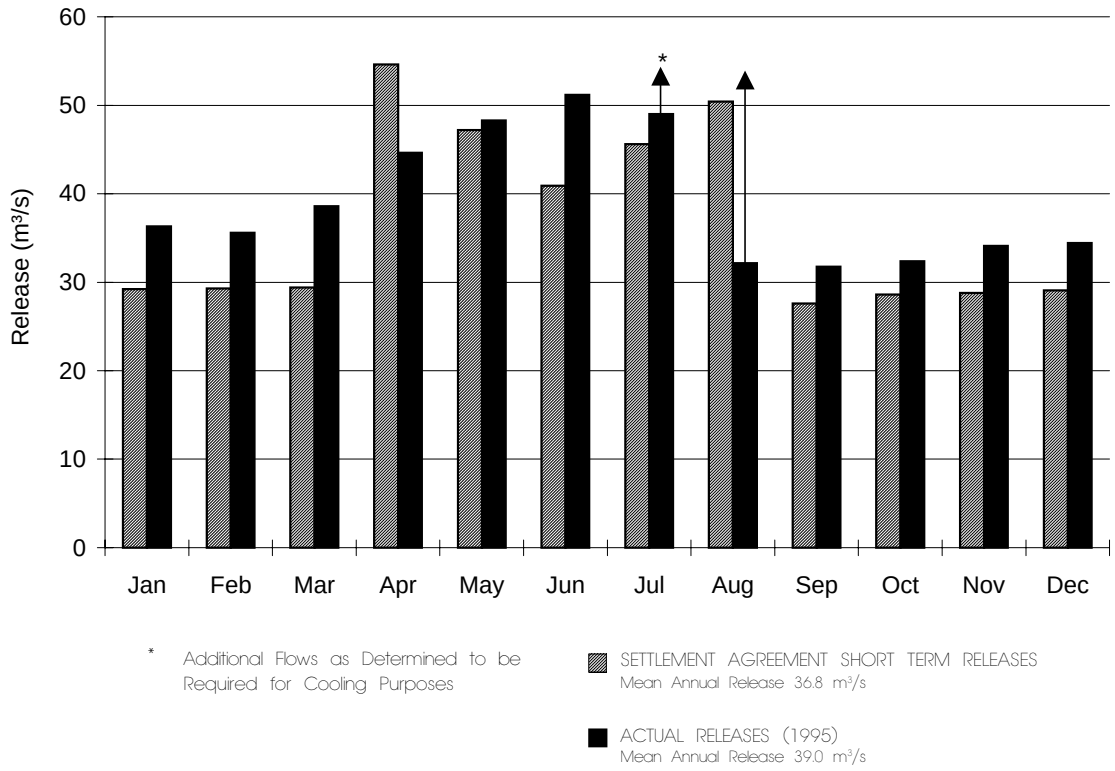
The release from Skins Lake Spillway was increased to approximately 49.0 m^3/s in mid April 1995 and maintained until early July 1995 when the release was further increased for the summer cooling flows. On August 17, 1995, the spillway release was reduced to 14.4 m^3/s to achieve the fall spawning flows in early September. The spillway release was then increased to 32.2 m^3/s on September 2, 1995 and maintained to achieve the annual water allocation for 1995/96. No forced spill occurred at Skins Lake Spillway during 1995.

APPROVED PROJECT 1996/97

In 1996/97, flow allocation will again be managed by the NFCP Technical Committee to best utilize available water.

Figure 1

COMPARISON OF ACTUAL AND SETTLEMENT AGREEMENT - SKINS LAKE SPILLWAY RELEASES
(January to December 1995)



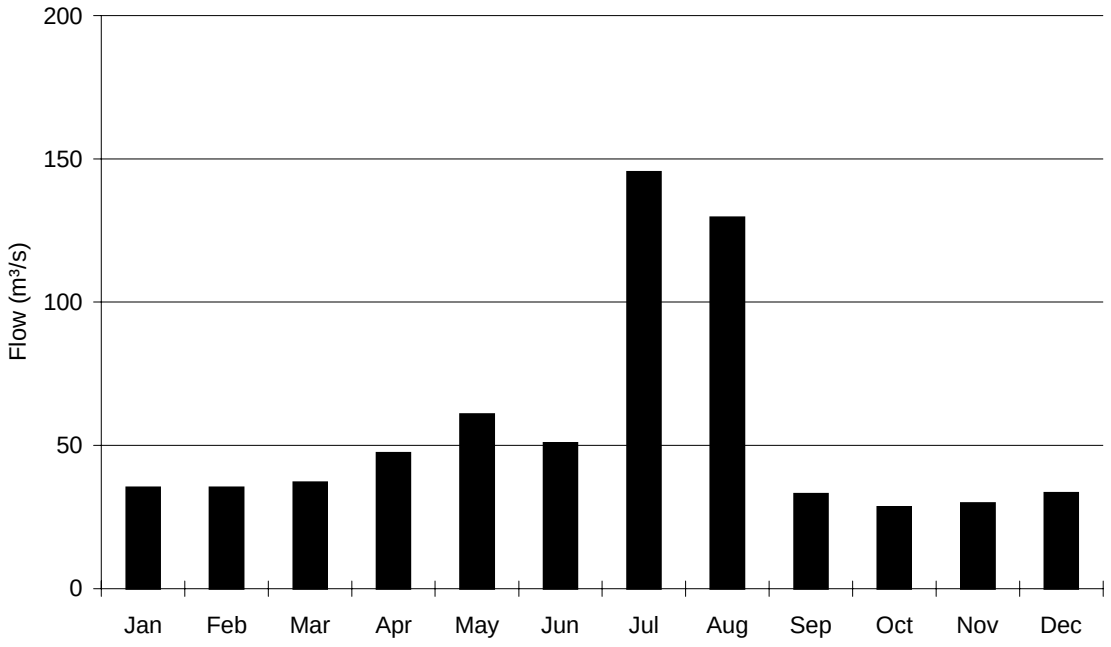
* Additional Flows as Determined to be Required for Cooling Purposes

SETTLEMENT AGREEMENT SHORT TERM RELEASES
Mean Annual Release 36.8 m³/s

ACTUAL RELEASES (1995)
Mean Annual Release 39.0 m³/s

FIGURE 2

ACTUAL FLOWS IN THE NECHAKO RIVER BELOW CHESLATTA FALLS
(January to December 1995)



Summer Water Temperature and Flow Management Project

RATIONALE

To protect sockeye salmon during their migration within the lower Nechako River, it is necessary to manage river water temperatures.

Nechako River flows and water temperatures are managed through releases from the Skins Lake Spillway. This is done in an attempt to maintain mean daily water temperatures at or below 20ºC in the Nechako River upstream of the Stuart River at Finmoore. Management is carried out through a computer-based program defined in the Settlement Agreement. The program protocol uses a trend analysis developed from five-day meteorological forecasts and daily in-stream temperature measurements to schedule releases from the Skins Lake Spillway.

PROJECT SUMMARY 1995/96

The Summer Water Temperature Management Program was again followed in 1995/96. The program was successful in maintaining the majority of mean daily water temperatures at or below 20.0ºC. Mean daily water temperatures exceeded 20.0ºC during July 20 to July 22. Temperatures reached a maximum of 20.3ºC on July 20 and 21. During this time, flows in the Nechako River below Cheslatta Falls were near the maximum allowable level of 283 m^3/s and thus no further actions could be taken.

The average flow in Nechako River below Cheslatta Falls was approximately 177 m^3/s during the water temperature control period. Increases in releases from Skins Lake Spillway above base flows from July 16 to 24 resulted in flows at Cheslatta Falls at or near 283 m^3/s. Mean daily water temperatures averaged 17.4ºC (range 15.0ºC to 20.3ºC) during the water temperature control period (July 10 - August 30).

APPROVED PROJECT 1996/97

The 1996/97 project will follow the same protocol and will be conducted in a manner consistent with previous projects.

IN-STREAM HABITAT COMPLEXES

Physical Assessment of In-Stream Habitat Complexes

RATIONALE

Cover habitat provides refuge for fish from fast-flowing water and predators, yet still allows them access to food in the river. As part of the pilot testing of remedial measures, a number of habitat structures (complexes) have been constructed in the Nechako River. The construction of habitat complexes at a larger scale was intended to manage the risk to chinook stocks associated with changes in the amount of in-stream cover habitat after the shift to the long-term flow regime with KCP. With the cancellation of KCP, the larger scale construction of these complexes is no longer contemplated.

The physical assessment of different pilot scale habitat complexes aids in the identification of the types of structures most suitable for use in the Nechako, or other rivers. As testing of the long term durability of the pilot structures was not yet complete when KCP was cancelled, the physical assessment of the structures is continuing, although at a reduced level of effort.

PROJECT SUMMARY 1995/96

In 1995/96, physical assessment and photographic/video documentation of the habitat complexes was conducted to provide a chronological record of the effects of winter conditions and summer cooling flows. In general, rail debris catchers, providing simulated log jam structures, continued to be durable although some debris loss was taking place in Reach 4. Debris bundle complexes were less durable than debris catchers.

APPROVED PROJECT 1996/97

In 1996/97, physical monitoring of habitat complex durability will continue. Also, it is proposed that habitat structures for emergent fry be tested. In addition, physical assessment and photographic/video documentation of the habitat complexes will continue to provide a chronological record of the effects of winter conditions and summer cooling flows.

Biological Assessment of Habitat Complexes

RATIONALE

Assessment of fish usage of the man-made habitat complexes will identify the most beneficial types of habitat complexes. These complexes must provide habitat for all life history phases of Nechako River juvenile chinook but not contribute advantageous rearing conditions to non-salmonids.

PROJECT SUMMARY 1995/96

Results from 1995/96 assessments continue to indicate good usage of the habitat complexes. Initial assessments (snorkel surveys) suggest that up to 67% of the chinook enumerated during May and June within Reach 2, and 33% in Reach 4, were associated with the habitat complexes. Furthermore, electroshocking surveys continue to provide evidence suggesting that the complexes are utilized as overwintering habitat by juvenile chinook.

APPROVED PROJECT 1996/97

Assessment efforts will continue in 1996/97. This year's project will include assessments in May and June, reflecting periods of maximum utilization observed during summer rearing flows. In addition, information gathered in April, July and November monitoring projects will also be utilized to investigate chinook utilization of habitat complexes. Controls and complexes constructed in previous years as well as a selection of natural sites will be assessed for juvenile chinook utilization as a comparison with the habitat complexes.

ADULT PROGRAMS

Adult Spawner Enumeration

RATIONALE

The number of adult chinook salmon returning to spawn in the Nechako River is the primary indicator reflecting the overall state of the Nechako River chinook salmon stocks and indicates achievement of the Target Population. As well, the number of chinook returning to the Stuart River are estimated to determine if observed trends in the Nechako stock are attributable to intrinsic or extrinsic factors.

PROJECT SUMMARY 1995/96

In 1995, 7 overflights were undertaken between August 19 and October 12 and the escapement was estimated as 1,689 spawners. This is an increase from the 1994 escapement of 1,144 spawners, but a decline from the 2,642 spawners estimated in 1990 (brood year). The Stuart River chinook carcass recovery project documented 3,730 returning spawners, an increase from last year's 2,420 spawners.

APPROVED PROJECT 1996/97

The 1996/97 project on the Nechako and Stuart Rivers will employ similar methods to those of previous years.

Adult Carcass Recovery

RATIONALE

The analysis of data from adult carcasses collected near the spawning grounds provides life history information on freshwater and marine components of Nechako River chinook salmon. This information aids in interpreting enumeration results and in indicating which brood years have contributed to the spawning population. It also aids in the determination of the success of juvenile rearing strategies and the quality of spawning habitat and condition of spawning fish. Data on age at return and egg deposition will also help in the interpreration and analysis of other monitoring projects.

PROJECT SUMMARY 1995/96

Adult chinook salmon carcasses were recovered from the Nechako and Stuart Rivers. The dominant age class in the Nechako River in 1995 was 5-year-old chinook (78%) with one complete year of fresh water residency. This information is consistent with the trend observed since 1988 (53.2 - 86.6% 5 year old).

APPROVED PROJECT 1996/97

In 1996/97 the carcass recovery project will continue to collect biological data on size, sex, age, life history, and egg retention of chinook.

INCUBATION ENVIRONMENT

The incubation environment refers to the habitat area and river conditions where salmon spawn. This environment is utilized during the winter months, from September to April, when the eggs and alevins are within the gravel.

Fry emergence is an indicator of the quality of the in-gravel environment and can also indicate when winter physical conditions have affected this environment. Studies are being conducted in each of these areas.

Gravel Quality and Dissolved Oxygen Monitoring

RATIONALE

The substrate of the Nechako River provides habitat for spawning, incubating, rearing, and food production for chinook salmon. The oxygen concentration in the interstitial gravel is directly related to emergent success of juvenile chinook salmon. One method to determine the quality of the incubation environment is through the measurement of intergravel dissolved oxygen.

PROJECT SUMMARY 1995/96

In 1995/96, the complete dissolved oxygen monitoring station was modified and operated on the Nechako River. Since July 1994, the equipment has been operational, serviced and calibrated every three months.

APPROVED PROJECT 1996/97

The equipment will remain in the river in 1996/97 to further test the data collection system. Pending the analysis of 1995/96 results, it will be used to collect baseline data.

Fry Emergence

RATIONALE

The quality and quantity of fry emerging from the gravel is a key indicator of the condition of the incubation environment. A monitoring project designed to assess emergent success and condition of fry serves as an early warning indicator of any changes in the incubation environment.

PROJECT SUMMARY 1995/96

In 1995/96, four inclined plane traps were installed at a major spawning area near Bert Irvine's (km19). The number of spawners and the index of the estimated number of fry have decreased in the last four years. Data indicate that the correlation between the number of spawners during previous years and the total number of emergent fry is very strong. This strong correlation validates the use of the index as an indicator of fry emergence. In 1995/96 a large number of trapped fry indicated good emergence success, indexed at 57% of fry emergence.

APPROVED PROJECT 1996/97

The 1996/97 project will repeat the program conducted in the previous five years. Four inclined plane traps will be installed at Bert Irvine's and mark/recapture experiments will be conducted to determine trap efficiency. The results of the fry emergence project continue to be important for monitoring the condition of the incubation environment in the Nechako River.

Winter Physical Conditions

RATIONALE

Understanding winter physical conditions and their effect on chinook incubation and overwintering in the Nechako River is important to gain a better understanding of the life history of the Nechako River stock.

Baseline data collected during the short-term flow regime contributes to the existing database. The information can be used as a basis for design and application of remedial measures in areas of severe icing conditions if required.

PROJECT SUMMARY 1995/96

In 1995/96, air and water temperatures, ice data, and discharge on the Nechako River were collected and added to the database.

APPROVED PROJECT 1996/97

In 1996/97, data will continue to be collected and analyzed and a report documenting the results of the project will be completed.

JUVENILE OUTMIGRATION

RATIONALE

The number and condition of juvenile chinook migrating down the Nechako River is an early indicator of the productivity of the river's spawning, incubation and rearing areas. Declines in numbers of outmigrants can provide a warning of any change in juvenile chinook survival.

Monitoring the timing and abundance of migrating juveniles on an annual basis will indicate any changes and will also provide life history and juvenile population information four to five years prior to the return of adult spawners. As outlined in the Strategic Framework, indications of changes in numbers of juvenile chinook leaving the system will determine subsequent monitoring and remedial action.

PROJECT SUMMARY 1995/96

In 1995/96, three rotary screw traps (RST) were again fished at Diamond Island. The peak catches of chinook fry at Diamond Island occurred during the third week in April while low numbers of chinook emigrated from the system throughout the sampling period (April 11 - July 13). The index of outmigration of the chinook population in 1995/96 based on RST catches was 45,025 juvenile chinook. The 1995/96 index further establishes a positive linear relationship with the number of spawners estimated above the Diamond Island trapping site.

APPROVED PROJECT 1996/97

In 1996/97, the three rotary traps will again be deployed at Diamond Island and run in conjunction with electrofishing. The traps will be fished from April 1 to the start of the summer water temperature cooling period, July 20, the period of greatest chinook outmigration. Index sampling (electrofishing) will be conducted in April, May, June, July and November.

TEMPERATURE MONITORING/PHYSICAL DATA COLLECTION

RATIONALE

The timing of emergence, growth rates and life history dynamics of chinook salmon are closely related to the temperature of their environment. Reliable collection of river temperature information forms part of the ongoing database of observed physical conditions in the Nechako River. The data is important in the designing of other monitoring projects and assessing the timing of juvenile chinook life history events.

PROJECT SUMMARY 1995/96

In 1995/96, the collection of physical data including air and water temperature and discharge was continued as in previous years. The data was applied to the fry emergence, juvenile outmigration, chinook enumeration and winter physical conditions projects, and was used primarily to explain the timing of biological and physical events.

APPROVED PROJECT 1996/97

In 1996/97, collection of baseline data will be continued to provide physical data to the other program components.

EVALUATION FRAMEWORK/TREND ANALYSIS

RATIONALE

The projects conducted by the NFCP consist of numerous physical and biological components. The need was identified for the Technical Committee to systematically analyze cause and effect relationships to best manage the overall program. This approach was developed within the context of the Conservation Goal outlined in the Settlement Agreement, to help accelerate action after the change to the long-term flow regime was deemed necessary. It will also help define the duration and effort required by monitoring and remedial measures projects to ensure that the chinook Conservation Goal will be met. With the cancellation of KCP and the resulting fact that there will not be a change in the flow regime, the Technical Committee will have to re-evaluate this decision framework in the future.

To adequately follow the decision path of the NFCP Early Warning Monitoring Program, a synthesis of the available data and completion of an initial trend analysis of the data is planned. This will be done for both sockeye and chinook salmon and documented in a formal report setting out the approach and criteria within which future decisions on the implementation of remedial measures will be undertaken.

PROJECT SUMMARY 1995/96

In 1995/96 preparation of an evaluation framework document was continued. Work was undertaken to better define the decision pathways and criteria as well as documentation of work completed to date. Most of the data analysed relate to the conservation of sockeye salmon.

APPROVED PROJECT 1996/97

In 1996/97, work will continue on the Strategic Framework document which will include sections on the Evaluation Framework, but in the context of the continuation of the existing flows as a result of the decision to cancel KCP.

PREDATION AND COMPETITION

RATIONALE

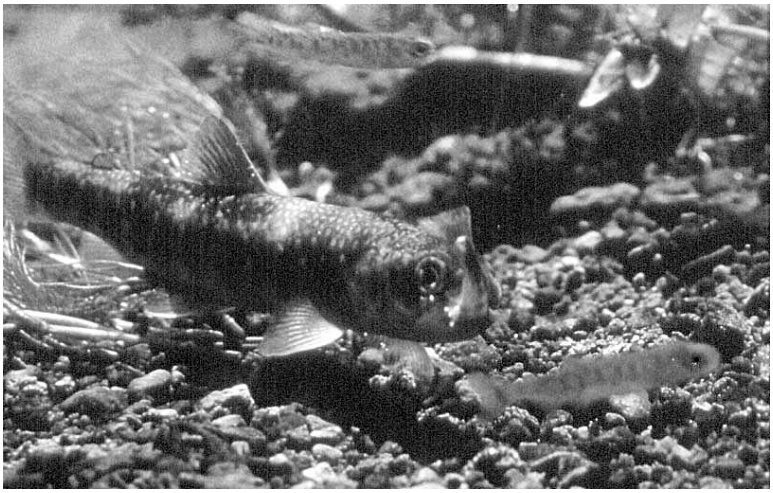
An understanding of the impact of predator and competitor populations upon juvenile chinook populations is necessary to determine if effort is required to control these populations. The relationships between juvenile chinook life history and predator abundance, distribution and impact must be investigated.

PROJECT SUMMARY 1995/96

Initial surveys on the Nechako River indicated moderate populations of mergansers, a known fish predator. A project on community structure along river margins suggested that juvenile chinook would not be the preferred food source for mergansers. The 1995 study was to capture mergansers and examine their stomach contents to confirm the percentage of juvenile chinook in their diets. This study will help quantify risk to chinook production from merganser predation. However, no work was done on this in 1995/96.

APPROVED PROJECT 1996/97

No further work is currently planned for this project.



TEMPERATURE EFFECTS

RATIONALE

Cooler water released from the Kenney Dam Release Facility into the Nechako River during the period of sockeye migration may affect invertebrate production, which is the food supply of chinook. An understanding of the effects of temperature on invertebrate production and fish growth has been identified as an area requiring further research.

PROJECT SUMMARY 1995/96

The study examining the effect of temperature change on invertebrates used as food by juvenile chinook was continued. A project conducted in 1994/95 has provided information on how to achieve temperature control in the field. Troughs were to be set up beside the Nechako River to conduct experiments in 1995, however, no work was done on this project in 1995/96.

APPROVED PROJECT 1996/97

No further work is planned on this project.

CHINOOK LIFE HISTORY MODEL

RATIONALE

The terms of reference for scientific input into the NFCP program include a life history model for the Nechako River Chinook. DFO Science is currently developing a life history model for the Fraser Basin. This model is based on approximately 1,300 1:20,000 TRIM maps forming a geo-referenced spatial platform. Streams are connected by an integrated network allowing spatial analysis upstream and downstream from a given point and providing over 1 million geo-referenced locations to assign attributes.

DFO is responsible for the management of Upper Fraser chinook salmon. These fish have complex life histories not yet fully understood. The construction of a Nechako chinook model which integrates habitat and fisheries data on a spatial platform will potentially further our understanding of these salmon populations and provide a tool for examining a variety of "what if scenarios".

PROJECT SUMMARY 1995/96

No work was carried out on this project in 1995/96.

APPROVED PROJECT 1996/97

Analysis of the data for the Chinook Life History Model will be refined on an ongoing basis. A workshop will be held to identify the parameters to be integrated into the model.

ECOLOGY OF JUVENILE CHINOOK SALMON

RATIONALE

Work conducted since the early 1980's has indicated that Nechako chinook spend one full year of residency in fresh water prior to migrating out into the ocean environment. This residency can take place either in the Nechako River or downstream in the Fraser River. Studies conducted in the upper Nechako River have documented large numbers of chinook juveniles migrating out of this river section within a period of 3 months after emergence. The downstream rearing distribution of these fish is not well known. Similarly, the rearing distribution of fry from chinook spawning in the middle reaches (km 80 - 140) is not well understood. There has been no recent work on the distribution and abundance of juveniles in the lower river (from the Stuart River confluence to Prince George).

A percentage of returning adults comes from juveniles that reared downstream and factors that affect their survival are important in determining overall adult abundance. This project will provide quantitative information on 1) the distribution of juveniles along the length of the Nechako River, 2) the importance of the lower Nechako and mainstem Fraser River for rearing, 3) the non-salmonid communities of the lower Nechako that may impact chinook through competition and predation.

The results of this project will attempt to fill gaps in our understanding of the relative roles of different habitats in producing juvenile chinook salmon. The data will be directly comparable to those recently collected on the Chilcotin, Bowron and Slim watersheds and will allow an assessment of flow regulation on the life history of the Nechako population.

PROJECT SUMMARY 1995/96

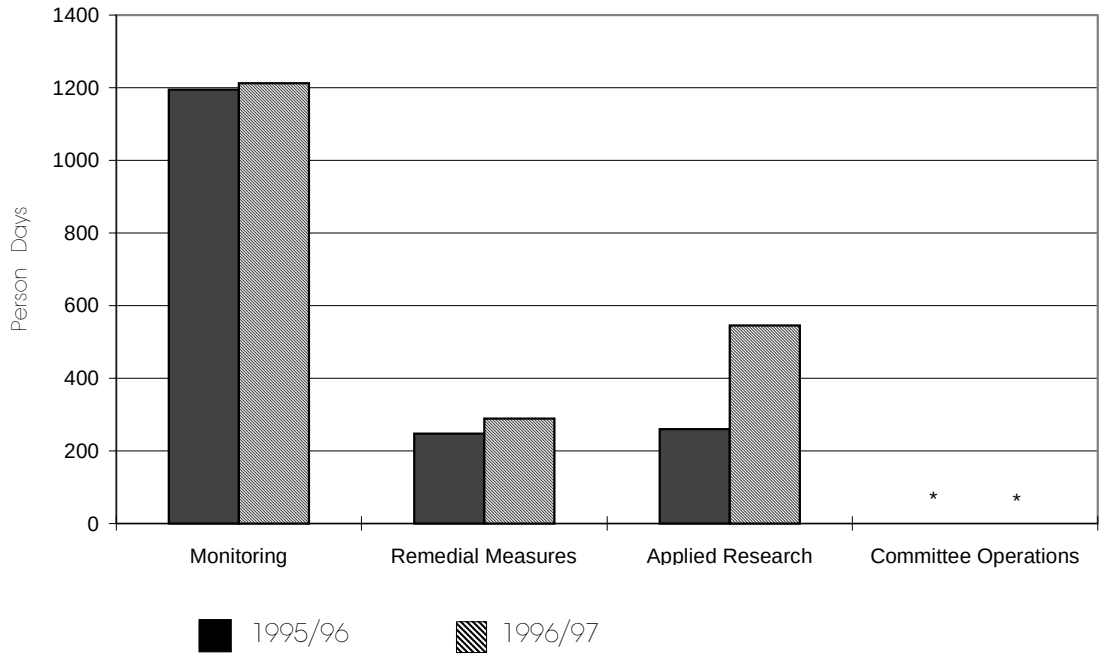
No work on this project was carried out in 1995/96.

APPROVED PROJECT 1996/97

During 1996/97 two Rotary Screw Traps will be operated in the Nechako River upstream and downstream of the Stuart River confluence, and a third trap will be operated in the Stuart River to assess downstream movements of juvenile chinook salmon. Rearing surveys of juvenile chinook will also be conducted by seining and electrofishing in the middle and lower Nechako River, to determine the distribution and abundance of rearing chinook salmon. DNA samples will be collected from juvenile chinook captured throughout the study area, and will be used to apportion each population. As well, a behavioural study using Nechako, Bowron, and Chilko River chinook will be undertaken to determine the various stocks' propensity to downstream migratory behaviour.

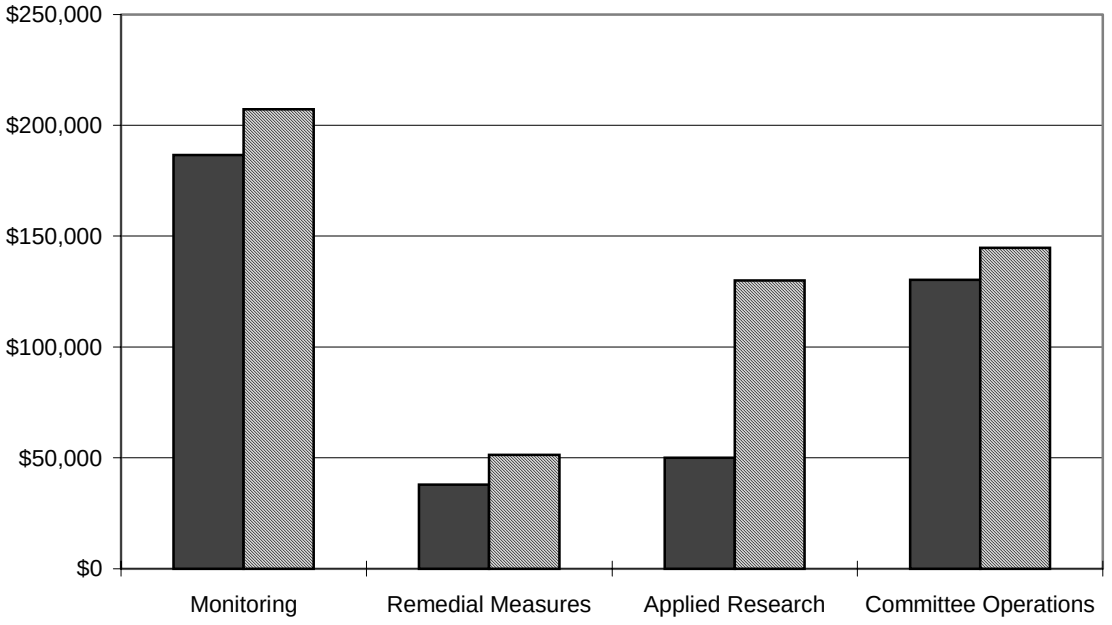
Summaries of the 1995/96 budget and the proposed 1996/97 budget are provided in Figures 3 & 4.

Figure 3
COMPARISON OF YEAR 8 & YEAR 9 MANPOWER BUDGETS

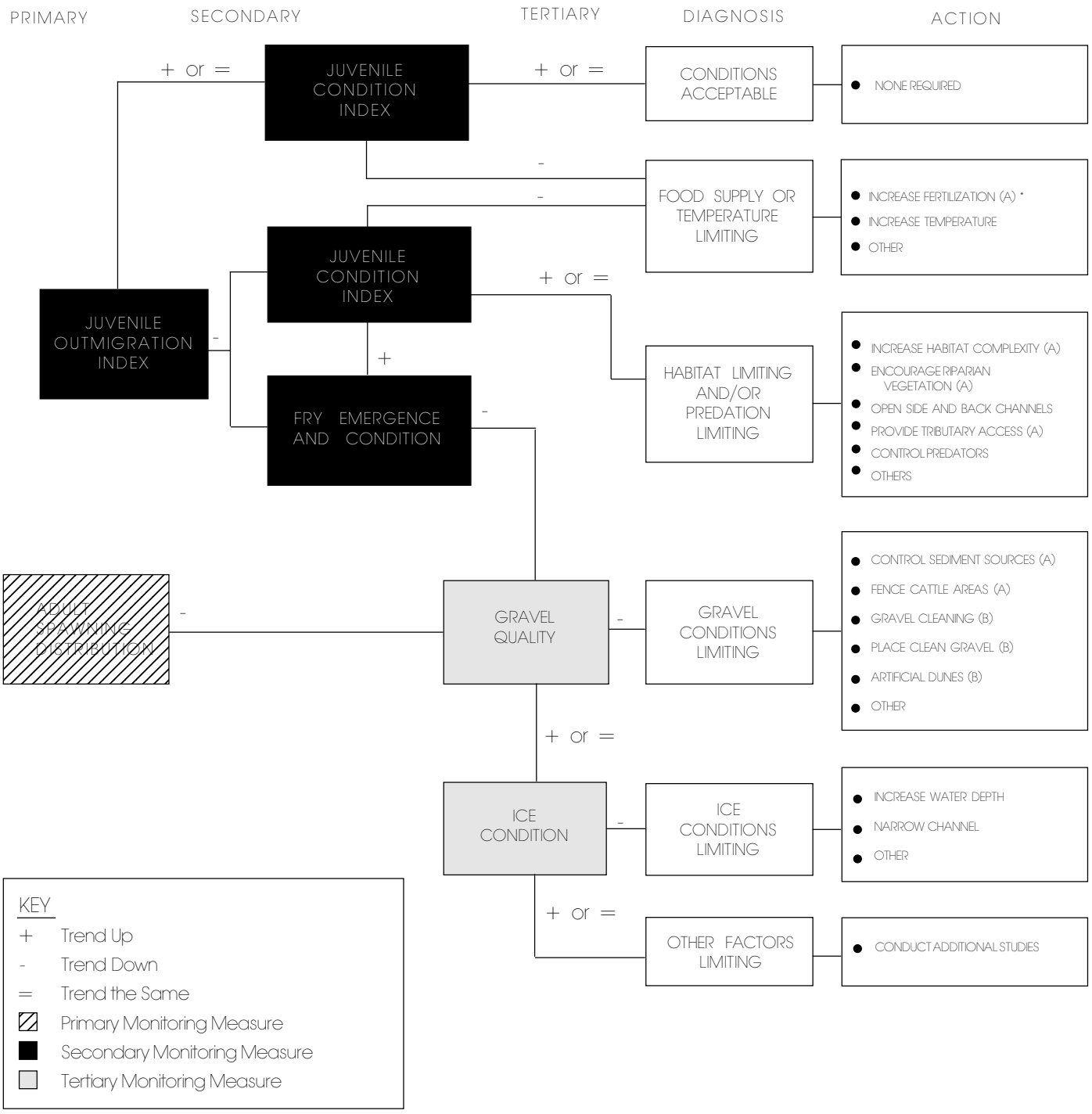


* Cost of manpower budgets are over and above the cost of disbursement budgets.

FIGURE 4
COMPARISON OF YEAR 8 & YEAR 9 DISBURSEMENT BUDGETS

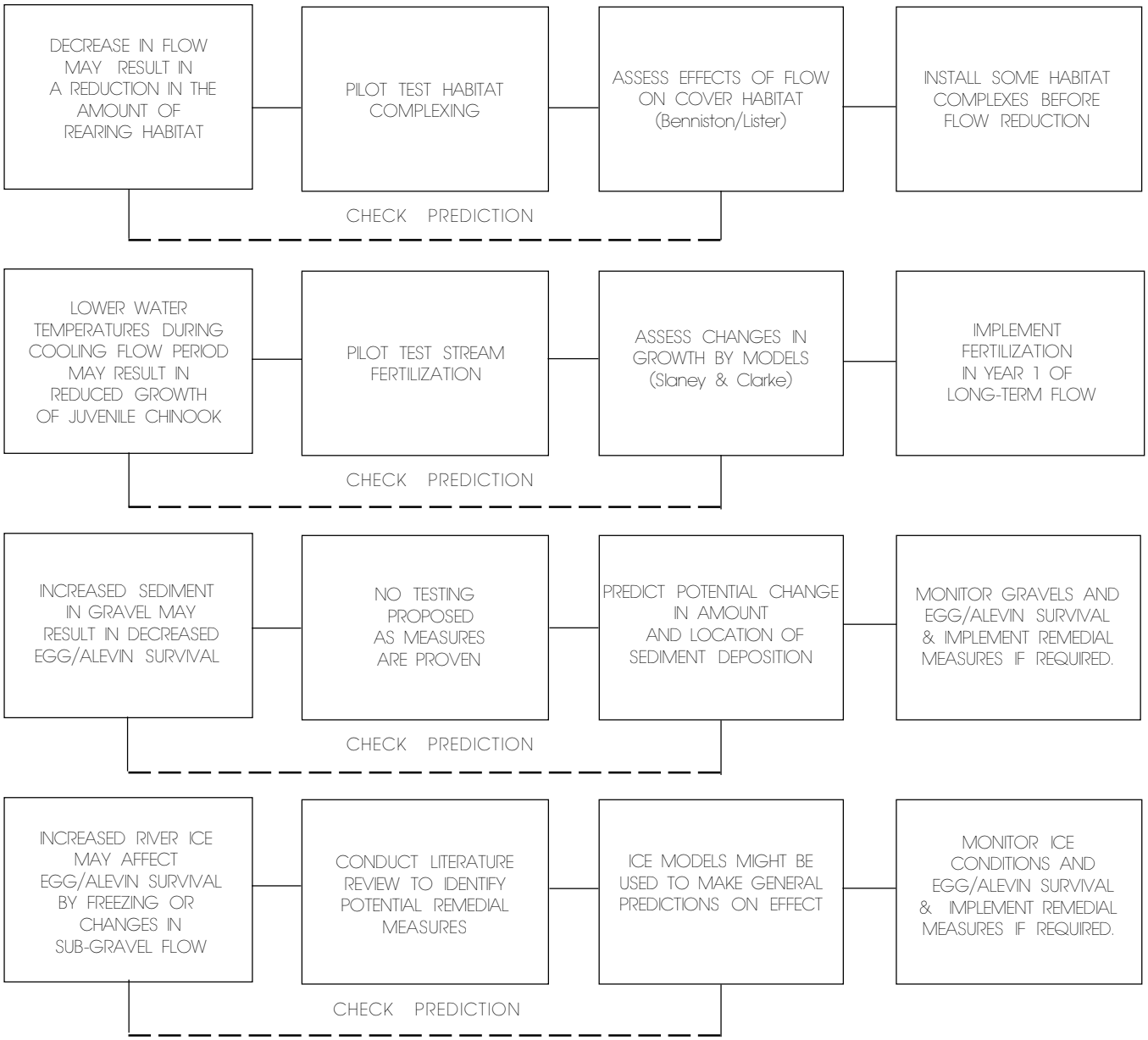


N.F.C.P. EARLY WARNING MONITORING PROGRAM

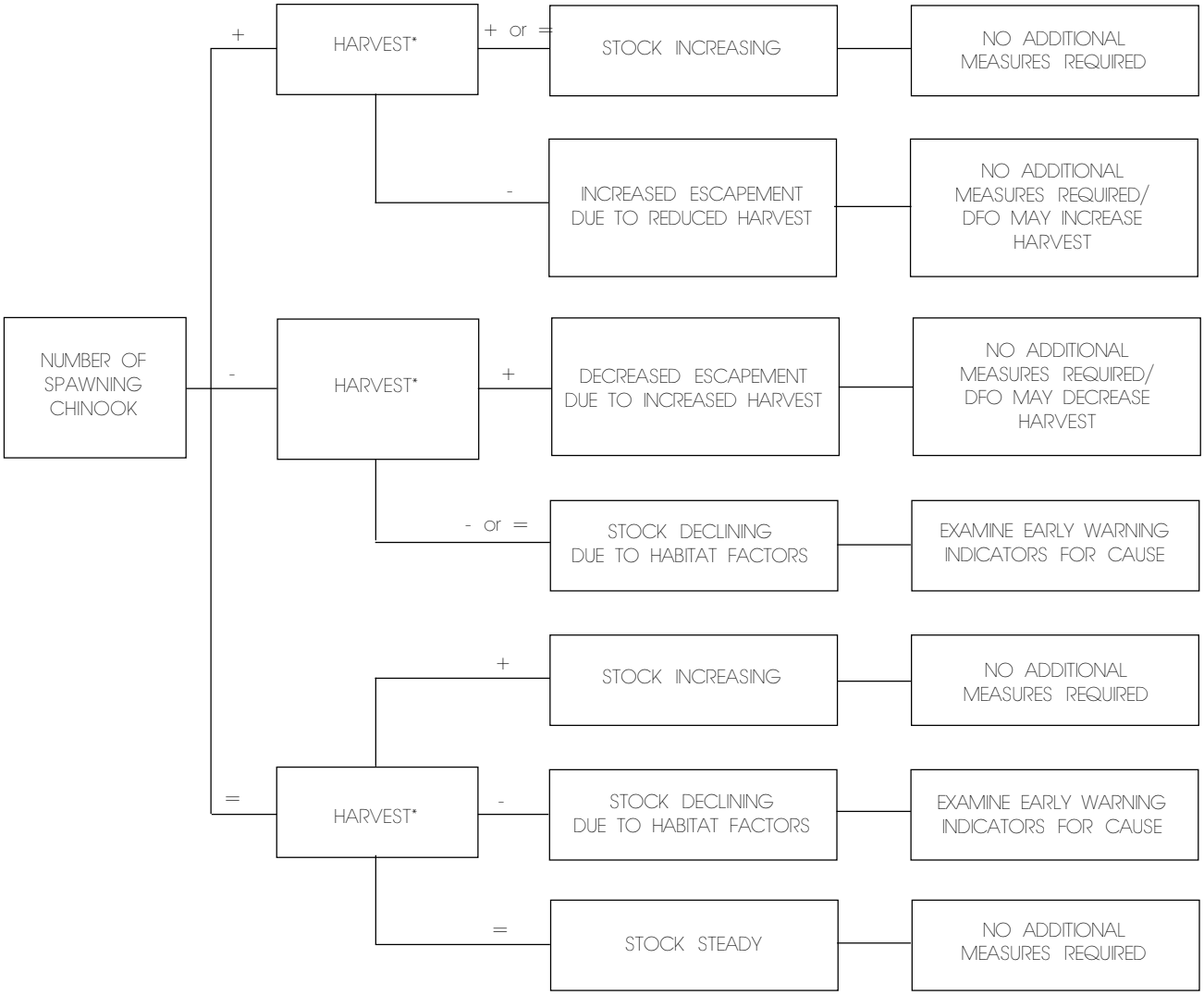


* Stage of Remedial Measures

DECISION CHART FOR REMEDIAL MEASURES PROGRAM



ASSESSMENT OF CONSERVATION GOAL



* Harvest analysis includes: comparison of trends in index stream, coastwide trends in chinook stocks and ocean survival.

LISTS OF REPORTS

REPORT NO.	TITLE	AUTHOR
RM95-1	Cheslatta/Murray Lakes Inflow Forecast Procedure	Triton Environmental Consultants Ltd.
RM95-2	The 1995 Summer Water Temperature and Flow Management Project	Triton Environmental Consultants Ltd.
RM95-3	Instream Habitat Complexing 1993 - 1995	Triton Environmental Consultants Ltd.
RM95-4	Biological Assessment of Habitat Complexing in the Nechako River, 1995	Triton Environmental Consultants Ltd.
RM95-5	Nechako River Flow Control 1995/1996	Triton Environmental Consultants Ltd.
M95-1	Nechako and Stuart Rivers Chinook Spawner Enumeration	DFO
M95-2	Nechako and Stuart Rivers Chinook Carcass Recovery	DFO
M95-3	Juvenile Outmigration	Triton Environmental Consultants Ltd.
M95-4	Winter Physical Conditions	DFO
M95-5	Nechako River Physical Data Summary - Database	DFO
M95-6	1996 Fry Emergence	Triton Environmental Consultants Ltd.
M95-7	Gravel Quality and Dissolved Oxygen Monitoring	DFO
M95-8	Evaluation Framework and Trend Analysis	DFO Triton Environmental Consultants Ltd.
AR95	Predation and Competition Temperature Effects	DFO

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